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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/604,154

06/27/2003

Yong Zhou

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ZIOLKOWSKI PATENT SOLUTIONS GROUP, SC (GEMS)

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EXAMINER

ABRAHAM, SALIEU M

ART UNIT

PAPER NUMBER

3709

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

03/26/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/604,154

Applicant(s)

ZHOU, YONG

Examiner

Salieu M. Abraham

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– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 January 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) 6,7,10,11 and 13-21 is/are allowed.
- 6) ☒ Claim(s) 1-5,8-9,12 is/are rejected.
- 7) ☒ Claim(s) 2-3 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 June 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>6/28/03 and 1/16/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description in Section [0005], page 3 of the specification with respect to figure 4:

- a. "The linear interpolation (B^a#2) of B-regions at frames 12 and 18"
- b. "The linear interpolation (C^a#2) of C-regions at frames 8 and 14"
- c. "The linear interpolation (D^a#2) of D-regions at frames 10 and 16"

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the examiner does not accept the changes, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The specification is objected to because of the following informalities:

- a. The abstract of the disclosure is objected to because the word "hystersis" is misspelled. Correction is required. See MPEP § 608.01(b).
- b. Reference in section [0029], page 12 of the specification to "Fifteen (*zero-encoding pulses*) would then be used to disrupt steady-state conditions between acquisition of region-D and region-A" contradicts the rest of disclosure which teaches the zero-encoding pulse as a means to enable and sustain steady state conditions. Correction is required. See MPEP § 608.01(b).

3. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d) and MPEP § 608.01(o). Correction of the following is required: While the terms slice encoding gradient, phase encoding gradient and large encoding gradient pulses are found in the specification, it is unclear what the reference in claim 12 to "one of phase-encoding gradient pulses and slice gradient pulses" relates to in the specification. There is no corresponding structure associated with a reference number or description of what structure(s) correspond to "one of phase-encoding gradient pulses and slice gradient pulses".

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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Claims 8,9 and 12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In Reference to Claim 8, the claim states: "The MRI apparatus of claim 7 wherein ***the increase in delay is a linear increase in delay time as the distance of the immediately preceding sampled peripheral*** from the center region increases."

It is unclear what is being claimed because the phrase "immediately preceding sampled peripheral from" is incomplete and unclear. Correction to the claim language is required in order to clearly "set out and define the invention with a reasonable degree of precision and particularity".

In Reference to Claim 9, the claim states: "The MRI apparatus of claim 8 wherein delay time after sampling a first peripheral region is a multiple of that observed after sampling of a second peripheral region." According to the disclosure, delays before sampling k-space center increase linearly with peripheral region distance from k-space center. The claim wording with regard to "first" peripheral region being a multiple of "second peripheral region" is in conflict with/contradicts what is disclosed: specifically, that the immediate prior peripheral region delay determines the immediate subsequent peripheral region delay (e.g. the second or immediate following region delay is a multiple of the first or immediate preceding region delay) and not vice versa.

Claim 12 recites the following limitation: "The MRI apparatus of claim 6 wherein amplitude of ***one of phase-encoding gradient pulses and slice-encoding***

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gradient pulses increases as the distance of each peripheral region from the center region increases". There is insufficient antecedent basis with reference to the "*one of phase-encoding gradient pulses and slice-encoding gradient pulses*" component of the limitation in the specification. Reference to two kinds of pulses are found in the overall disclosure:

Large Encoding Gradient Pulses

Zero-Encoding Pulses

Zero-Encoding Pulses are described liberally throughout the disclosure, but no description is made with regard to the essence or structure of large encoding gradient pulses. It is, therefore, unclear what is being referred to by the phrase "one of phase-encoding gradient pulses and slice gradient pulses". Appropriate correction is required to definitively set out/describe what is being claimed.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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6. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. No. 5,713,358 to Misretta (Misretta) in view of U.S. Patent Application Pub. No. US 2003/0032877 to Watts (Watts).

In Reference to Claim 1

Misretta teaches:

A method of MR data acquisition comprising the steps of:

- a. "sampling peripheral regions of k-space at a pre-selected temporal rate" (see Misretta abstract and column 11, lines 55-59 and 62-63);
- b. "wherein the ***center region is sampled at a higher temporal rate; otherwise sampling the next region of k-space at the pre-selected temporal rate***" (see Misretta column 3, lines 56-62, column 4, lines 2-18, column 7, lines 65-67 and column 8, lines 19-27)).

However, Misretta does not teach: "waiting a ***predetermined period*** of time before sampling a next region of k-space if the next region of k-space is a center region of k-space".

Watts teaches: "waiting a ***predetermined period*** of time before sampling a next region of k-space if the next region of k-space is a center region of k-space" (see Watts, page 10, claim 23) in order to obtain higher fidelity image data when acquiring k-space center that directly impacts reduction/minimization of time-resolved contrast kinetics-based and fast MR image noise (see Watts page 2, section/paragraph [0018]) and improves overall image quality (see Watts

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abstract, page 2, section [0027], lines 6-11, and Conclusion/section [0103], lines 1-4).

It would have been obvious to one having ordinary skill in the art to have added the "waiting a ***predetermined period*** of time before sampling a next region of k-space if the next region of k-space is a center region of k-space" of Watts in the "sampling peripheral regions of k-space at a pre-selected temporal rate;

"wherein the center region is sampled at a higher temporal rate; otherwise sampling the next region of k-space at the pre-selected temporal rate" of Misretta in order to consistently acquire high quality MR images and minimize image noise contributions as explicitly taught by Watts.

7. Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. No. 5,713,358 to Misretta (Misretta) in view of Watts, and further in view of Jezzard, Peter "Physical Basis of Spatial Distortions in Magnetic Resonance Images." in: Bankman, Isaac N., Handbook of Medical Imaging Processing and Analysis (San Diego, Academic Press, 2000), pp. 425-435; hereinafter Jezzard (Jezzard).

In Reference to Claims 4

Misretta in view of Watts has been shown to teach all of the limitations of claim 1.

Jezzard further teaches:

The method of claim 1 further comprising the step of maintaining

steady state of the MR signal to minimize signal intensity variation (see Jezzard, p. 434, section 6.2 "Non-Steady State Effects", and equations 11 and 12) in order

to have a well designed pulse sequence such that when the (MR) "image signal is detected, the spins have reached a steady state."

In Reference to Claim 5

Misretta in view of Watts has been shown to teach all of the limitations of claim 1.

Jezzard further teaches:

The method of claim 1 further comprising the step of playing out a

series of zero-encoding pulses during the predetermined period of time (see Jezzard, p. 434, section 6.2 "Non-Steady State Effects", and equations 11 and 12) in order to allow "enough dummy excitations (scans) of the spin system" so "that the spins may attain a steady state" as well as minimize or eliminate any "substantial artifacts" or "Fourier Noise" in the reconstructed image that could potentially result from non-steady state conditions.

It would have been obvious to one having ordinary skill in the art to have included the dummy scans/acquisitions of Jezzard in the predetermined waiting period of Misretta in view of Watts in order to maintain steady state conditions as explicitly taught by Jezzard and allow sufficient delay for noise or artifact contributions to diminish as implicitly taught by Jezzard.

Allowable Subject Matter

8. Claims 6-7, 10-11 and 13-21 are allowed.

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9. Claims 2 and 3 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

10. Claims 8, 9 and 12 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action.

11. The following is a statement of reasons for the indication of allowable subject matter:

In Reference to Claims 6-13

In a method according to claim 6, the inclusion of the MRI signal sampling delay to fill the center region as a function of the distance of an immediately preceding sampled peripheral region from the center region (of k-space) in combination with the other claim 6 steps was not found or fairly suggested by the prior art.

In Reference to Claims 14-21

In a computer readable storage medium having stored thereon a computer program according to claim 14, the inclusion of a predetermined value that is a function of the distance an immediately preceding sampled peripheral region is from the center of k-space in determining the center of k-space sampling delay and, in combination with the other claim 14 steps was not found or fairly suggested by the prior art.

In Reference to Claims 2-3

The inclusion of the predetermined period of time as a function of peripheral region distance from the center region of k-space in combination with the limitations of claim 1 was not found or fairly suggested by the prior art.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Korosec, Ookawa, Riederer, and Wang have been included because they all teach variable rate k-space sampling by center and peripheral regions whereby the central region is sampled so as to provide the key image information. They also emphasize the region-based temporal and sampling order significance in the image acquisition and reconstruction processes. Additionally, Rose and Groen have been included because they teach eddy current compensation by minimal or non-disruptive gradient encoding methods which favorably influence or significantly improve MR Image signal to noise, noise suppression and image acquisition; these compensation regimes mitigate distortional eddy current induced effects as well.


13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Salieu M. Abraham whose telephone number is 5712721990. The examiner can normally be reached on Monday through Thursday 8:30 am - 6:00 pm EST.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Bomberg can be reached on 5712724922. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

02/08/07 SA


KENNETH BOMBERG
PRIMARY EXAMINER